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Materials, Manufacturing and Testing Requirements for Offshore Mooring Steel Wire Ropes, Sockets and Pins

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Abstract

The trend to produce oil at constantly deeper water has led to the development of floating production solutions for the exploitation of the energy resources in these areas. Steel wire ropes have been used and are being proposed used, as line segments in the majority of the mooring systems of these units. Typical applications covered are mobile offshore units and permanent moored floating production, storage and offloading systems.

Choice of wire rope construction and extent of corrosion protection is of vital importance and should be evaluated as a function of field design life and possibilities for replacement of the wire rope segments.

Performance criteria should be specified for the socketing compound. During production these criteria should be verified by relevant tests. Socketing procedures should be established and controlled before casting of resin.

Steel material for the wire ropes and sockets should be properly documented and be subjected to relevant tests. Mechanical test samples should be taken from full size sockets or from test coupons specially approved.

A design assessment including prototype testing of the wire rope construction and socket should be performed. Wire rope manufacture and manufacture and assembly of sockets and accessories should be according to a Quality Plan accepted by the parties involved.

This paper may serve as a technical reference document in contractual matters between the purchaser and manufacturer. It may also serve as a guideline for designers, purchasers and contractors.

Introduction

Steel Wire Rope Constructions

Steel wire rope segments of mooring lines could be of various constructions as shown in Figure 1. Other type of constructions may also be used if relevant experience can be documented.

The stranded rope constructions include a number of strands wound in the same rotational direction around a center core to form the wire rope. The number of strands and wires in each strand (e.g. 6×19, 6×36, 6×61) are governed by required strength and bending fatigue considerations for the wire rope. This construction generates torque as tension increases.

The torque balanced spiral rope constructions (spiral strand, half locked and full locked coils) do not generate significant torque with tension changes. These constructions use layers of wires (or bundles of wires) wound in opposing directions to obtain the torque balanced characteristics. The half locked and full locked coil constructions consist of one or more layers of shaped wires over the basic spiral rope construction resulting in a design more resistant to the ingress of corrosion media. The shaped layer(s) of wires will also prevent any outer wire fracture from unwinding. These constructions will normally give higher load capacity related to nominal diameter due to the increased metallic area, compared to other constructions.